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PATENT ABSTRACTS OF JAPAN

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(71)Applicant : MATSUSHITA ELECTRIC WORKS LTD

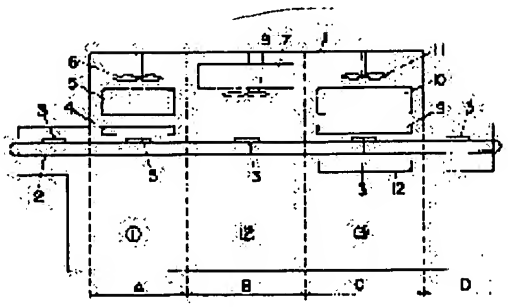
(72)Inventor : OSE HIROFUMI
MAZAKI HIROSHI
HASHIMOTO YUJI

(54) REFLOW SOLDERING METHOD

(57)Abstract:

PURPOSE: To provide a reflow soldering method which can obviate cleaning with little inferiority in soldering and besides little flux residue.

CONSTITUTION: The inside of a reflow furnace 1 is divided into three sections under nitrogen atmosphere, and a preprocessor (1), which bears the pretreatment process of rapidly raising the temperature of a printed wiring board 3 to a preheating temperature, is provided on the entrance side, and a preheater (2), which bears a preheating process of preheating the printed wiring board 3, at the center, and further a reflow part (3), which bears a reflow process, on the exit side. The preprocessor (1) raises the surface temperature of the printed wiring board 3 being carried, at the rate of about 2-3°C/sec, and finally raises the temperature to about 130°C. The preheater (2) raises the surface temperature of the printed wiring board 3 slowly from about 130°C to about 160°C, taking about 80sec. The reflow part (3) raises the surface temperature of the printed wiring board 3 within the range of a maximum of 230°C, and further bears the evaporation of flux.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the reflow soldering approach used for a wiring substrate like a printed-circuit board.
[0002]
[Description of the Prior Art] Although many the so-called RA type of cream solder had been conventionally used in reflow soldering in atmospheric air, in order to secure soldering nature, the halogenides (chlorine etc.) of a considerable amount were included. Therefore, since possibility that the amount of this halogenated compound will become the cause of causing the corrosion of the printed-circuit board which is a wiring substrate, migration, etc., and it will have a bad influence on dependability was high, the washing stroke was needed after soldering.
[0003] However, there is a problem on environments, such as processing of a penetrant remover, etc. in a washing stroke, therefore no washing-ization has been required in recent years. Then, moreover, the amount of flux evaporated between reflow excluding the halogenated compound in the cream solder to be used, and although the approach the residue of the flux after reflow termination uses few solder creams of low residue has come to be used, this approach also had the following problems.
[0004] That is, since it was a reflow in the inside of atmospheric air, solder did not fully spread round the surface of metal by oxidation of a surface of metal, but there was a problem that the wettability of solder was bad, and there were problems, like generating of a detailed solder ball increases by oxidation of cream solder further. Moreover, the conventional reflow method of construction is the purpose which controls dispersion in the solder skin temperature by the difference in the heat capacity of the loading components of a printed-circuit board. The pretreatment process A in which the PUNRINTO wiring substrate which entered in the reflow furnace as shown in drawing 5 is skyrocketed to preheat temperature (for example, 150 degrees C) for a short time (for example, 4 degrees C/sec) The preheating process heated with fixed time amount (for example, 80sec extent) and fixed preheat temperature since it corresponds to the above-mentioned purpose after reaching preheat temperature, Temperature is raised after this preheating process progress more rapidly than solder melting temperature, and rice field attachment consists of a cooling process D which takes out the already ended printed-circuit board from a reflow furnace, and is cooled in the progress second half of the reflow process C in which reflow solder is performed, and this reflow process C.
[0005]
[Problem(s) to be Solved by the Invention] By the conventional method of construction which holds above preheat temperature uniformly, when the cream solder of low residue was being used for wash [no]-izing, since the flux component beyond the need evaporated in the preheating process B, there was a problem that a flux operation fell and got wet and led to the increment in a defect and the increment in generating of a solder ball. Moreover, when temperature of this preheating process B was conversely made low, there was also a problem that the so-called chip **** etc. occurred.
[0006] Moreover, although temperature may be rapidly raised to about 150 degrees depending on the class of cream solder when performing reflow soldering where the cream solder 23 is applied between

the terminal 20 of electronic parts, and copper-foil face 21a of a printed-circuit board 21 as shown in drawing 6 (a) In this case, the binder in the flux of the cream solder 23 became soft, as mold collapse of cream solder 23 the very thing showed drawing 6 (b), it occurred, and there was also a possibility of becoming the cause which makes the solder ball 24 like drawing 6 (c).

[0007] Succeeding in this invention in view of the above-mentioned trouble, the place made into the purpose is to offer the reflow soldering approach that there is little poor soldering, there is moreover little flux residue, and no washing-ization can be attained.

[0008]

[Means for Solving the Problem] This invention is a reflow furnace in nitrogen-gas-atmosphere mind, in order to attain the above-mentioned purpose. The pretreatment process in which the temperature of the wiring substrate which is the reflow soldering approach which uses the solder cream of low residue, and applied the solder cream is raised rapidly, It is characterized by consisting of the preheating process in which it is made to go up gently to the temperature near the second half rice field melting temperature of a pretreatment process, the reflow process in which it is made to go up to the temperature corresponding to reflow soldering, and the cooling process that cools the wiring substrate after reflow process termination.

[0009]

[Function] According to this invention, by performing reflow soldering in nitrogen-gas-atmosphere mind, oxidation of the metal tabulation side of a wiring substrate is reduced, therefore solder fully spreads round a surface of metal, and the so-called wettability improves. Moreover, when wettability improves, since soldering and metal table face-to-face soldering reinforcement improve, dependability becomes high. Furthermore, the occurrences of the solder ball by oxidization are reduced.

[0010] According to and the preheating process in which it is made to go up gently to the temperature near the second half rice field melting temperature of a pretreatment process Since the flux of the cream solder of low residue can lessen the amount which evaporates in a preheating process, the fall of a flux operation in a reflow process decreases. a result -- nitrogen-gas-atmosphere mind -- depending -- solder -- a ball -- in addition to the generating reduction effectiveness, generating of a solder ball can be lessened more, therefore no washing-ization which does not need washing can be attained by the reduction effectiveness of flux residue and the generating reduction of a solder ball by low residue solder cream use.

[0011]

[Example] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 shows the reflow furnace used for this invention approach, a printed-circuit board 3 is sent in by conveyor 2 from an end, and, as for this reflow furnace 1, the printed-circuit board 3 of soldering termination is sent out from the other end. A printed-circuit board 3 is what carried electronic parts, such as chip TORANJITA which should be soldered to a circuit pattern, as shown in drawing 2 , and before putting into the reflow furnace 1, the cream solder of low residue is applied to a soldering part.

[0012] Pretreatment section ** which bears the pretreatment process A in which the inside of the reflow furnace 1 is classified into three parts under the ambient atmosphere of nitrogen, and the temperature rise of the printed-circuit board 3 is rapidly carried out to an entrance side to preheat temperature Moreover, preheating section ** which bears the preheating process B in which a printed-circuit board 3 is heated beforehand, in a center section Reflow section ** which bears the reflow process C is prepared in the outlet side, respectively. To pretreatment section **, the skin temperature of the printed-circuit board 3 on a conveyor 2 furthermore, in order to make it go abruptly up with 2-3 degrees C / sec extent as shown in drawing 3 , [for example,] It has the heater 4 arranged near the upper part of a conveyor 2, and the heater 5 arranged a little up from this heater 4, and the warm air of a suitable wind speed is caudad put in the fan 6 who prepared above the heater 5 to the printed-circuit board 3 currently conveyed by conveyor 2. It ** and, finally the skin temperature of a printed-circuit board 3 is raised at 130 degrees C of abbreviation in this pretreatment section **.

[0013] Preheating section ** of a degree arranges a heater 7 near the head-lining section, puts warm air in the fan 8 whom this heater 7 prepared caudad to the printed-circuit board 3 currently conveyed by

conveyor 2, and raises the skin temperature of a printed-circuit board 3 gently over the time amount of for example, about 80 sec extent from about 130 degrees C to about 160 degrees C. In the preheating process B by this preheating section **, equalization and a flux operation (washing-izing of a substrate) of solder temperature are started.

[0014] While reflow section ** is equipped with the heater 9 arranged near the upper part of a conveyor 2 like pretreatment section **, and the heater 10 arranged a little up from this heater 9 The warm air of a suitable wind speed is caudad put in the fan 11 who had the heater 12 under the conveyor 2 and prepared above the heater 10 to the printed-circuit board 3 currently conveyed by conveyor 2. While soldering by raising the skin temperature of a printed-circuit board 3 in a maximum of 230 degrees C in this reflow section **, a flux operation is made prosperous and flux is evaporated further. The reflow process C which this reflow section ** bears serves as a between [about 30 sec(s)] grade. After passing this reflow section 3, it becomes a cooling process D, and in this cooling process D, the printed-circuit board [finishing / soldering] 3 will be cooled.

[0015] It **(ed) and the cream solder (for example, Matsushita Electric Industrial Co., Ltd. make MR-7733) of low residue was applied to the above-mentioned printed-circuit board 3 by this invention approach, when passed through each process A-C and D which succeeded in a temperature setup which shows the reflow furnace 1 shown in drawing 1 to through and drawing 3 , flux residue was reduced extremely, and the printed-circuit board 3 without the need of washing, with which it succeeded in soldering was obtained.

[0016] Table 1 shows the case of this invention approach which passed through each process A-C, and the occurrences of the average solder ball of the conventional approach of a temperature setup shown in drawing 5 by temperature setup shown in drawing 3 , and as shown in this table 1, compared with the conventional approach, as for this invention approach, the yield of the number of solder balls is reduced by 3 by about 1/. This result is a result significant for wash[no]-izing. In addition, a sample is the printed-circuit board 3 shown in drawing 2 , there are a chip transistor, SOP, etc. in loading components, and the substrate of the glass epoxy resin of 0.8mm thickness is used as a substrate.

[0017]

[Table 1]

温度設定	サンプル数	平均半田ボール数（個）
図5の場合	12	19．3
図3の場合	12	5．3

[0018] Moreover, drawing 4 (a) and (b) show the relation between an oxygen density, and the number of poor wettability and the number of solder balls, and when an oxygen density uses a low residue cream low so that clearly from this drawing, it turns out at (b) that each number is reduced. Moreover, when the conventional cream solder is used, the number of solder balls is reduced so that the oxygen density of (b) is low, but the number of poor wettability is not stable compared with (b), when a low residue cream is used. According to the reflow soldering approach in nitrogen-gas-atmosphere mind, this drawing also shows that the occurrences of poor wettability and the number of solder balls are reduced by low residue cream use.

[0019]

[Effect of the Invention] The pretreatment process in which the temperature of the wiring substrate which this invention is a reflow furnace in nitrogen-gas-atmosphere mind, is the reflow soldering approach which uses the solder cream of low residue, and applied the solder cream is raised rapidly, Since it consists of the preheating process in which it is made to go up gently to the temperature near the

second half rice field melting temperature of a pretreatment process, a reflow process in which it is made to go up to the temperature corresponding to reflow soldering, and a cooling process that cools the wiring substrate after reflow process termination When oxidation of a metal tabulation side is reduced, solder fully spreads round a surface of metal, and it is effective in the so-called wettability improving and wettability improves According to the preheating process in which dependability becomes high since soldering and metal table face-to-face soldering reinforcement improve, the occurrences of the solder ball by oxidization are reduced further, and it is moreover made to go up gently to the temperature near the second half rice field melting temperature of a pretreatment process The amount in which the flux of the cream solder of low residue evaporates in a preheating process can be lessened. Therefore, the fall of a flux operation in a reflow process decreases, and, in addition to the generating reduction effectiveness of the solder ball by nitrogen-gas-atmosphere mind, generating of a solder ball can be lessened more. Therefore, it is effective in the ability to attain no washing-ization which does not need washing by the reduction effectiveness of the flux residue after the reflow process termination by low residue solder cream use, and generating reduction of a solder ball.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram of a reflow furnace used for this invention approach.
[Drawing 2] It is the perspective view of an example of the printed-circuit board by which reflow solder is carried out by the same as the above.
[Drawing 3] It is the explanatory view of a temperature setup of each process same as the above.
[Drawing 4] (a) is the related explanatory view of the number of poor wettability, and an oxygen density. (b) is the related explanatory view of the number of solder balls, and an oxygen density.
[Drawing 5] It is the explanatory view of a temperature setup of the conventional approach.
[Drawing 6] It is the explanatory view of the trouble of the conventional approach.
[Description of Notations]
** Pretreatment section
** Preheating section
** Reflow section
1 Reflow Furnace
2 Conveyor
3 Printed-circuit Board

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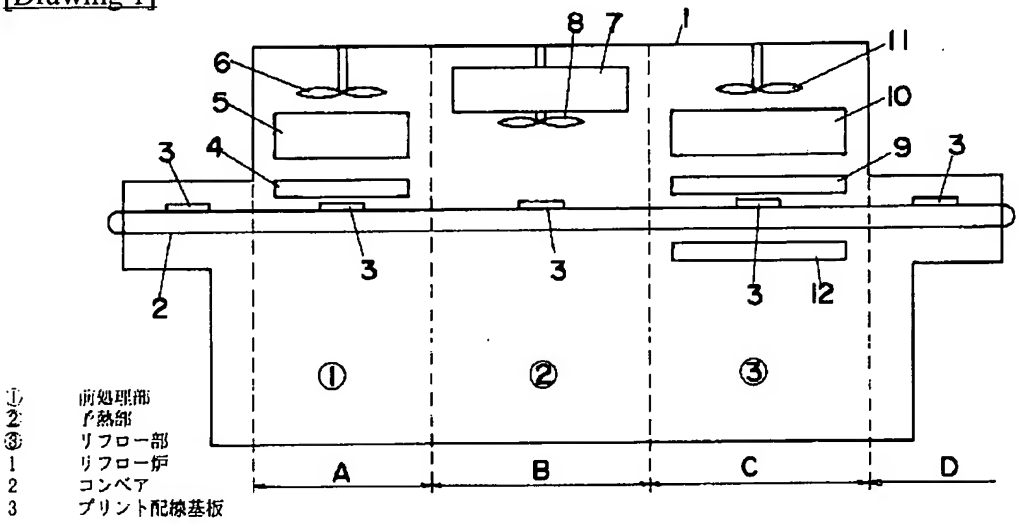
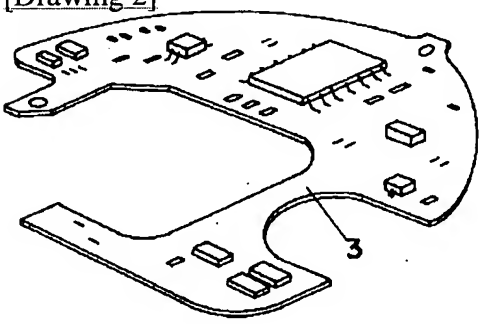
DRAWINGS

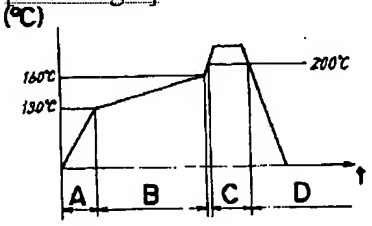
[Drawing 1]



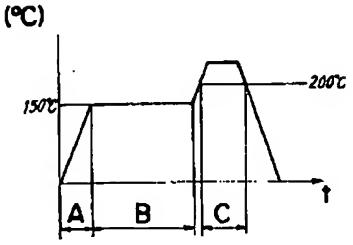
[Drawing 2]



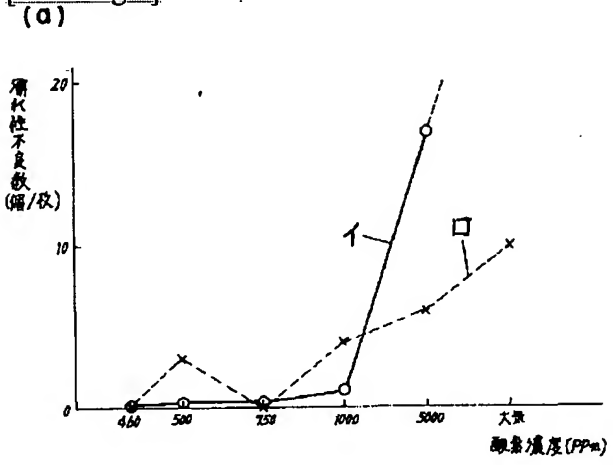
[Drawing 3]



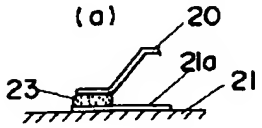
[Drawing 5]

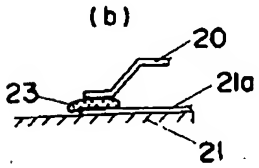


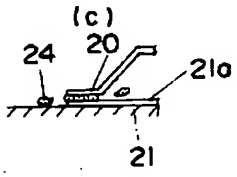
[Drawing 4]



[Drawing 6]







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CLAIMS

[Claim(s)]
[Claim 1] The pretreatment process in which the temperature of the wiring substrate which is the reflow soldering approach which uses the solder cream of low residue, and applied the solder cream at the reflow furnace in nitrogen-gas-atmosphere mind is raised rapidly, The reflow soldering approach characterized by consisting of the preheating process in which it is made to go up gently to the temperature near the second half rice field melting temperature of a pretreatment process, the reflow process in which it is made to go up to the temperature corresponding to reflow soldering, and the cooling process that cools the wiring substrate after reflow process termination.

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